Table 1: The maximum, 2cc, 1cc and 0.1cc doses for different dose sum methods and organs. "Rigid" uses a 6D rigid registration; "Deformable" uses deformable registration (Mirada RTx); "Raw Sum" is the voxel-wise sum over prescribed doses; "Biol Sum" uses biological effects; "Healing" assumes that the effect of the prior treatment is only 75% of its original dose due to tissue healing. The deviation from the Rigid Raw Sum is shown in brackets (%).

Organ		Rigid Raw Sum	Deformable Raw Sum	Deformable Biol Sum	Deformable Raw Sum with Healing	Deformable Biol Sum with Healing
Medulla	max	65	67 (3.0%)	58 (-10.6%)	61 (-5.8%)	54 (-16.1%)
	D2cc	60	62 (4.9%)	53 (-11.6%)	57 (-3.5%)	49 (-17.1%)
	D1cc	61	63 (4.4%)	54 (-11.4%)	58 (-4.0%)	50 (-17.1%)
	D0.1cc	63	65 (3.7%)	56 (-11.4%)	60 (-5.1%)	52 (-17.3%)
Mandibula	max	112	109 (-2.3%)	108 (-3.2%)	96 (-13.8%)	96 (-13.7%)
	D2cc	105	104 (-1.5%)	101 (-4.4%)	91 (-13.3%)	92 (-12.8%)
	D1cc	107	106 (-1.4%)	104 (-3.6%)	93 (-13.1%)	93 (-13.2%)
	D0.1cc	111	108 (-2.2%)	107 (-3.5%)	95 (-13.8%)	95 (-14.0%)
Area at pharynx	max	106	105 (-0.6%)	106 (-0.4%)	95 (-10.7%)	96 (-9.0%)
	D2cc	97	90 (-6.9%)	90 (-6.7%)	83 (-14.3%)	85 (-11.5%)
	D1cc	98	91 (-7.4%)	91 (-7.7%)	84 (-14.9%)	86 (-12.6%)
	D0.1cc	103	97 (-6.5%)	95 (-7.8%)	88 (-15.3%)	89 (-14.0%)
Larynx	max	106	106 (0.3%)	103 (-2.3%)	93 (-12.0%)	92 (-13.4%)
	D2cc	101	102 (1.5%)	98 (-2.7%)	90 (-11.3%)	89 (-12.1%)
	D1cc	102	103 (1.0%)	100 (-2.6%)	91 (-11.6%)	90 (-12.5%)
	D0.1cc	105	105 (0.2%)	102 (-2.8%)	92 (-12.2%)	91 (-13.2%)

Results: The maximum doses (in EQD2) for different critical organs in the H&N case are presented in Table 1, along with doses calculated without deformable registration or compensation for biological dose effects. For medulla, deformable EQD2 values are approximately 10% less than for the rigid raw sum; for other organs the difference varies from 0 to 8%.

Conclusions: Considerations of dose to organs at risk may be a limiting factor for treatment planning of secondary malignancies at the same site. This work has shown a complete framework to examine re-treatment planning accounting for different patient positions, dose sizes and fractionation schemes of new and previous treatments. This accurate summed EQD2 distribution is helpful in seeing which dose tolerances are reached, and where the treatment plan could be modified further.

PD-0524

Visualization tool for Electromagnetic Dosimetry and Optimization (VEDO) during deep hyperthermia

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Purpose/Objective: Hyperthermia is still regarded as the most potent biological sensitizer for radiotherapy and chemotherapy. In addition to positive results multiple phase III trials, in many studies a statistical significant relationships between applied thermal dose and treatment effectiveness were found. The, prospective study of Jones et al. [1] and the large, retrospective study of Franckena et al. [2] are highly convincing and demonstrate a clear rationale for thermal dose escalation. These findings motivated us to develop a software to apply HT under objective control of an on-line hyperthermia treatment planning (HTP) system. International consensus exists that the application of HT will benefit strongly from on-line HTP with 3D-visualization and control of the heating pattern in the patient.

Materials and Methods: A software tool called VEDO (Visualization tool for Electromagnetic Dosimetry and Optimization) was created. The inputs required are: a 3D segmentatio of the patient model comprising all tissues, target, OAR and pre-calculated electromagnetic fields. VEDO calculates Specific Absorption Rate (SAR) distributions and performs optimization using a particle swarm (PS) optimization algorithm. Spatial optimization weighting regions can be manually set. Clinically important quantifiers like predicted target SAR dose and maximum allowed power, based on SAR in critical tissues, are visualized.

Results:

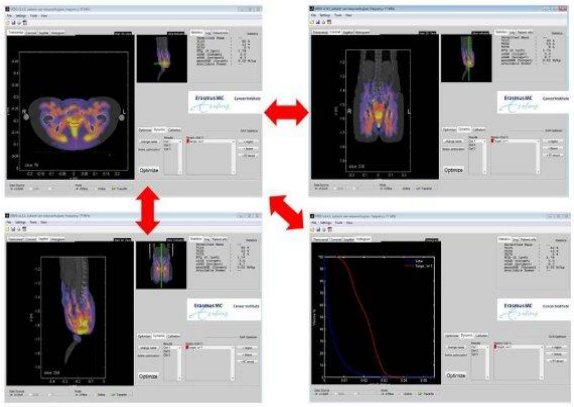

Fig. 1 GUI of VEDO (Visualization tool for Electromagnetic Dosimetry and Optimization)

VEDO provides an instant visualization of the SAR-distribution (as color wash) over the patients CT using the simulated electric fields and real-time measured phase and amplitude of the signals fed to each antenna element. Pre-treatment, VEDO is used by the MDs for decision making. During treatment, VEDO helps the operator to correlate the location of pain-complaints to predicted high SAR values near the indicated region; allowing re-optimization for reduction of the SAR at the indicated 'hot-spot' area. With this, complaint-adaptive SAR steering is used to convert hotspots in re-optimized settings, with reduced local SAR, that can directly be applied to the patient anatomy. In patients with head and neck tumors complaint adaptive SAR steering resulted in at least 20% increase of the SAR delivered to the target.

Conclusions: VEDO is completely objective and quantitative, and can be evaluated on its effectiveness. The latter is an important step towards abandoning treatment optimization based on experience of the hyperthermia staff members. The simulations using the patient anatomy also provides much more insight as compared to experimental SAR measurements in homogeneous phantoms. Clinical application of VEDO shows that the workflow is feasible and that re-optimization based on patient discomfort is effective in reducing complaints.

1 - Jones EL et al. Randomized trial of hyperthermia and radiation for superficial tumors. JCO. 2005, 3079-85.

2 - Franckena M et al. Hyperthermia dose-effect relationship in 420 patients with cervical cancer treated with combined radiotherapy and hyperthermia. EJC. 2009, 1969-78.

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PD-0525

Analysis of recurrence probability versus pre-treatment FDG-PET SUV for RT patients with HNSCC for dose painting

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Purpose/Objective: To determine the relationship between recurrence locations and pre-RT ^{18}F-FDG PET SUV data for patients diagnosed with HNSCC.

Materials and Methods: Based on a patient group of 90 patients treated with IMRT or VMAT, a retrospective investigation of local variations in TCP depending on pretreatment ^{18}F-FDG PET SUV through use of recurrence